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INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS

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Report date - November 8, 1972

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16. Abstract Two of the three DCP transmitters were installed on September 8 following modification by General Electric. Discolored infestations of ponderosa pine are being located and sized on CIR transparencies taken September 8 by the Forest Service airplane. RB-57 photography from Missions 205, 211, and 214 were received and are being indexed and analyzed. Imagery from the C-130 flight has also been received and indexed. Some ERTS imagery has been received for each site. At each of the primary sites (Atlanta, Black Hills, and Manitou) only small portions of each site are covered. Clouds have precluded capturing good imagery over the center of each site. A computer program was completed from microdensitometer scans of CIR photos which maps areas of an image which are spectrally similar. Decided differences between forest types are present as well as differences between forest and other vegetative and nonvegetative land classes.			
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Figure 2. Technical Report Standard Title Page

TITLE: Inventory of Forest and Rangeland and Detection of Forest Stress

ERTS Proposal Number 226

Black Hills Test Site (Forest Stress) 226A

Coinvestigator: Frederick P. Weber

GSFC Identification Number AG-014

Principal Investigator - Robert C. Heller

STATEMENT OF PROBLEMS:

1. We received our first ERTS images on October 30 for the September 8 overflight. This pass covered only about one-third of our test site. Channel 6 was completely garbled with missed scan lines and breaks along the scan lines.

2. We have had several failures in our power supply for operation of our three DCP's in the Black Hills. This occurred over a two-week period (September 11-22) and coincided with a C-130 overflight on September 15. However, we have been collecting and transmitting data since that time.

3. We received the overflight photography for both the RB-57 (Mission 211) and C-130 (Mission 213) aircraft. The RB-57 photos are underexposed over forest land--properly exposed over the plains and agricultural land. The C-130 photos are well exposed, but the test site was missed on all but three exposures. It is unlikely that there will be enough 24-channel MSS imagery available for analysis.

ACCOMPLISHMENTS DURING THE REPORTING PERIOD:

1. The RB-57 photography (Mission 211) has been edited and nadirs plotted. The imagery was received October 30.

2. C-130 photography was received November 3 and the nadirs plotted on maps for the three exposures which covered our test site.

3. Photo interpretation of the CIR transparencies (scale 1:32,000) taken September 8 over the northern Black Hills by the Forest Service Aero Commander is two-thirds complete. All infestations are being plotted on templates and recorded by size in meters and the numbers of trees per infestation. The infestations will be used as differing sizes of resolution targets for the ERTS imagery.

4. The DCP site was checked for sensor operation November 1-6 and the third DCP transmitter installed.

5. F. P. Weber spent three weeks in Iran, on temporary assignment to the EROS program, assisting in training personnel from CENTO (CENTral Treaty Organization) countries in the collection and the analysis of ground, aircraft, and ERTS data for application to forestry, rangeland, and agriculture.

WORK PLANNED FOR NEXT REPORTING PERIOD:

1. Complete photo interpretation of 1:32,000 CIR transparencies and transfer locations to 1:24,000 USGS maps with Bausch & Lomb Zoom Transfer Scope. Find UTM coordinates for infestations greater than 50 meters in size. Make templates of UTM locations for training and test samples.

2. Design sampling survey to check accuracy of interpretation from RB-57 imagery (RC-8 and Hasselblad) as compared to ground sample and ERTS imagery when it becomes available. Make ground examination of small sample of selected infestation sizes.

3. Compare biophysical data output from ground data logger (VIDAR) with DCP/DCS data sent to us from Goddard Space Flight Center.

4. Begin analysis of ERTS data when it covers our site and becomes available.

SIGNIFICANT RESULTS: None

PUBLICATIONS:

1. Heller, Robert C. 1972. Remote Sensing in Forestry--Promises and Problems. To be published in Proceedings from annual meeting of the Society of American Foresters, Hot Springs, Arkansas. October 1-5, 1972.

2. Heller, R. C., B. Spada, and A. M. Woll. 1972. Remote sensing in resource evaluation, planning, protection and management. To be included in Proceedings of the Seventh World Forestry Congress, Buenos Aires, Argentina, October 4-18, 1972.

3. Weber, F. P., R. C. Aldrich, F. G. Sadowski, and F. J. Thomson. 1972. Land use classification in the southeastern forest region by multispectral scanning and computerized mapping. Paper presented at the Eighth International Symposium on Remote Sensing of Environment, Ann Arbor, Michigan, October 2-6, 1972.

RECOMMENDATIONS FOR CHANGES: None

STANDING ORDER FORM CHANGES: None

ERTS IMAGE DESCRIPTOR FORMS: One; Image 1047-17175-4

DATA REQUEST FORM CHANGES: Please send more Image Descriptor Forms

TITLE: Inventory of Forest and Rangeland and Detection of Forest Stress

ERTS Proposal Number 226

Atlanta Test Site (Forest Inventory) 226B

Coinvestigator: Robert C. Aldrich

GSFC Identification Number AG-014

Principal Investigator - Robert C. Heller

STATEMENT OF PROBLEMS:

1. We have received limited ERTS data for the Atlanta test site. Data received have been partial coverage with the effective areas under adverse cumulus, cirrostratus cloud conditions. We have found the data marginal in usefulness.
2. All negatives received to date are too dense to be usable for enlargement for field use.

ACCOMPLISHMENTS DURING THE REPORTING PERIOD:

1. Aircraft support data flown in early June by MSC (RB-57 Mission 205) were received on September 17. The data have been reviewed and edited. The 851 forest and land use points selected for training and testing interpretation techniques have been transferred from Mission 191 imagery to the new imagery. These data were taken to the field for ground checks during the period October 5 through 11.
2. Aircraft support data flown on October 2 by MSC (RB-57 Mission 214) were received on November 1. These data are being reviewed and edited preliminary to transferring forest and nonforest training and test set locations from the Mission 191 imagery.
3. A portable photometer has been developed to evaluate channel illumination on the I²S Addicol Viewer. This device was necessary to allow us to return to illumination levels for individual channels in each image enhancement. This would be necessary when the enhancements must be set up for supplemental evaluation or to photograph the enhanced image at some later date.
4. A camera mount has been built for the I²S viewer that will accept a Speed Graphic camera with 75 mm focal length lens. This camera mount and camera (with a 70 mm or 620 roll film back) can be installed

and rapidly calibrated with the I²S enhanced image to make color composites necessary in our photo interpretation test.

5. Transparent overlays were made from the training and test set base map negatives. These overlays were scaled to match the I²S viewer or 1:1,000,000.

6. ERTS Image Analysis was completed for scene 1048-15434X (September 9, 1972).

Cumulus clouds and high cirrostratus cloud layers exist in over 50 percent of the scene area. Approximately 50 percent of the test site was fairly free of clouds. However, the effect of high moisture caused a thin haze which degraded the reflectance values. Channels 4, 5, and 7 were properly processed and were used in an optical combiner. Processing imperfections (horizontal scan line data gaps) in channel 6 make this channel unusable.

In general, the resolution and spectral characteristics of this scene are inferior to the Apollo 9 (SO-65) IR color film for the same area. The scene covers ERAP test blocks 1, 2, 3, 4, 8, 9, 10, and 14. After careful examination of these blocks, we were unable to discriminate between agricultural uses, i.e., crops, pasture, idle land, or transitional land. Generally, all agricultural land is a light grayish pink when channel 4 is projected through a blue filter, channel 5 through green, and channel 7 through red. Hardwoods in large areas are bright red; however, when hardwood and pine occur in small patches as they normally do in this region, there is no real distinction between the two. A few major roads appear--those that run north and south more often than those that run east and west. Channel 4 adds little information; in fact this channel appears to throw a haze into the combined image. Channels 5 and 7 together provide the greatest detail. For instance, channel 5 provides the cultural detail, i.e., roads, urban development, and agricultural boundaries. Channel 7 provides water (good reference points for locating specific areas) and some tonal differences between pine and hardwood forests.

7. A computer program has been completed which maps areas of an image which are spectrally similar. The resulting maps are being compared with type maps made from large-scale photos. No ERTS imagery has yet been available for the areas that we have type mapped. To test the program we have used four-color data from microdensitometer scans of color IR imagery taken from high-altitude aircraft (scale 1:120,000). The preliminary results are encouraging. Decided differences between forest types are present as well as differences between forest and other vegetative and nonvegetative land classes. The clustering of image elements based on spectral similarities is being done in several ways. Programs to relate the spectral classes to land types are now being written.

Other pattern recognition programs are ready and will be used when the ERTS precision tapes for our training and test samples are available. These include multivariate linear discrimination procedures and k-nearest neighbor procedures.

WORK PLANNED FOR NEXT REPORTING PERIOD:

1. Depending on the receipt of ERTS data, we will train interpreters to identify eight land use classes using three interpretation devices.
2. Data from aircraft support Mission 214 (October 2, 1972) will be annotated for filing. All 851 data points for the ERTS experiment will be examined and transferred to the new imagery.
3. Computer programming will continue. We hope to have an additional programmer soon to speed up this work.
4. ERTS imagery will be combined and enhanced as received. These enhanced images will be copied when advisable and used in training aids as well as in enlarging interpretation devices.

SIGNIFICANT RESULTS: None

PUBLICATIONS: None

RECOMMENDATIONS FOR CHANGES: None at present

STANDING ORDER FORM CHANGES: None

ERTS IMAGE DESCRIPTOR FORMS: Two forms have been returned to GSFC.
Images 1030-15432X and 1048-15434X

DATA REQUEST FORM CHANGES: None submitted

TITLE: Inventory of Forest and Rangeland and Detection of Forest Stress

ERTS Proposal Number 226

Manitou Test Site (Rangeland Inventory) 226C

Coinvestigator: Richard S. Driscoll

GSFC Identification Number AG-014

Principal Investigator - Robert C. Heller

STATEMENT OF PROBLEMS:

1. Personnel turnover precluded accomplishing all work planned for this reporting period. One technician returned to school full time, one technician returned to school half time, and we lost one full-time scientist. These positions may not be filled soon due to difficulty in recruiting qualified personnel caused by lack of sufficient Forest Service funding and the lateness of our NASA proposal financing.
2. Only one batch of bulk processed MSS ERTS-1 data, Observation ID 1009-17075, has been received of the Manitou site from a possible five data passes over the site by the satellite. Data taking occurred on August 1 during the first cycle, but included only the eastern one-quarter of the 226C test site. Also, registration slippage among the MSS channels during processing produced nonsynchronous areal coverage which negates proposed analysis techniques.
3. Aircraft support data flown in June during Mission 205 by the NASA/MSC WB57F aircraft provided little information about the western one-half of test site 226C due to cloudy skies. Data about the eastern one-half of the test site is good.

ACCOMPLISHMENTS DURING THE REPORTING PERIOD:

1. All Mission 205 photographs were received by September 25. This material has been indexed in relation to location within the test site. Also, the testing, training, and validation points representing the previously reported vegetation and land use classes are currently being located and indexed on the intermediate scale color infrared photographs. This job is approximately one-fourth completed.
2. Bulk processed ERTS-1 MSS imagery, Observation ID 1009-17075, was received September 12. Due to the problem previously described, analysis has not progressed. The problem was identified to NDPF Data Users Service and additional bulk processed data ordered.

3. A transparent overlay of that portion of the test site known to be included in the MSS ERTS-1 imagery received has been prepared. Testing, training, and validation points included in this imagery are being plotted on this overlay and are keyed to UTM.

4. Precision processed data of ERTS-1 Observation ID 1009-17075 has been retrospectively ordered but not received.

5. A detailed analysis plan "Microdensitometry for analysis of ERTS-1 and supporting aircraft data" is 90 percent complete. Prospectuses for data analysis plans "Human interpretation of ERTS-1 and supporting aircraft data" and "Multistage sampling with ERTS-1 and supporting aircraft data" have been developed.

6. WB57F Mission 211 was completed September 16 over the test site. According to the mission report, the western one-half of the test site was covered. The eastern one-half of the area was not covered apparently due to cloudy skies. The data have not been received.

7. Mission 213 flown by the NASA/MSC C-130 aircraft was completed September 13-14. The aerial photographs have just been received but have not been reviewed.

8. The intensive ground data obtained at Manitou proper at the time of the first satellite data pass have been approximately 50 percent reduced.

WORK PLANNED FOR NEXT REPORTING PERIOD:

1. Complete the transparent overlays identifying the location of training and test sets included in the available ERTS data. Scale these for use for: (1) microdensitometric interpretation, (2) human interpretation, and (3) possibly additive color interpretation.

2. Complete the analysis plans as previously defined.

3. Complete data point transfer to Mission 205 aerial photography and proceed with interpretation testing.

4. As received, log Mission 211 data into our file system, transfer training and testing points to this photography, and proceed with interpretation testing.

5. Complete intensive ground truth data analysis and relate the results to multiscale/multispectral photography obtained by the Forest Service Aero Commander and the WB57F aircraft and the spacecraft.

SIGNIFICANT RESULTS: None to report due to the lateness of receiving aircraft and spacecraft data and the need to reorder bulk processed MSS data.

PUBLICATIONS: None released

RECOMMENDATIONS FOR CHANGES: None at present

STANDING ORDER FORM CHANGES: One; to secure three copies of bulk processed ERTS data.

ERTS IMAGE DESCRIPTOR FORMS: None yet due to faulty ERTS imagery.

DATA REQUEST FORM CHANGES: One; to secure three copies each of precision processed ERTS imagery.